

EVALUATION OF SOUTHERN PINE BEETLE INFESTATIONS ON THE
BIG THICKET NATIONAL PRESERVE, TEXAS

By

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INTRODUCTION

In September 1976, at the request of the National Park Service, Forest Insect and Disease Management conducted aerial sketchmap surveys and ground evaluations on two units of the Big Thicket National Preserve in Texas. The areas evaluated were the Beech Creek Unit (4,856 acres) and the Loblolly Unit (550 acres).

The evaluation was conducted to determine the extent of damage and current level of southern pine beetle activity on the units, and to provide recommendations for handling the southern pine beetle infestation on the Big Thicket National Preserve.

HISTORY AND BACKGROUND INFORMATION^{1/}

The Big Thicket National Preserve was established under Public Law 93-439 by 16 U.S.C. 698 in October 1974 "in order to assure the preservation, conservation and protection of the natural, scenic and recreational values of a significant portion of the Big Thicket area in the State of Texas . . .". The National Park Service is currently in the process of acquiring the lands within the designated units for the Preserve. Within 5 years after the enactment, areas of the Preserve will be reviewed for suitability or non-suitability for designation for preservation as wilderness under the Wilderness Act.

^{1/} Information for the history and background information was obtained from several sources. Main sources include letters and in-service reports, as well as word of mouth communication, provided by the Texas Forest Service; letters and communication with personnel of the Big Thicket National Preserve; GAO report (B-125035) from the Comptroller General of the United States to Congressman Steelman; Public Law 93-439, 93rd Congress, H. R. 11546; and the Forest Pest Control Act (165-9 V. C. S.) for the State of Texas.

Units of the Big Thicket Preserve are located in an area north and northwest of Beaumont, Texas (Fig. 1). This area traditionally has a history of southern pine beetle activity. Lands within the designated units are predominately owned by six major timber companies. Remaining lands are owned by small landowners. In view of the pending acquisition of lands, the timber companies voluntarily established a cutting moratorium on lands set aside for the Big Thicket National Preserve.

International Paper Company and Temple-Eastex were the principal landowners of the Beech Creek Unit lands. Early in January 1975, a large southern pine beetle infestation was detected by International Paper Company on this area. The National Park Service in Beaumont, Texas was notified of the outbreak and requested to provide recommendations on how to control the infestation. At that time, the Park Service did not own the land and funds for acquisition had not yet been appropriated. They could only relate their preferences for control in accordance with the recommendations and guidelines of the U. S. Forest Service. Cut and salvage appeared to be an acceptable solution; however, the environmental impact of the salvage method was of some concern.

The Texas Forest Service (TFS) has the responsibility of detecting, investigating and controlling forest pests in forested lands in the State of Texas as outlined in the Texas Forest Pest Control Law (165-9 V. C. S.). In March 1975, the Texas Forest Service contacted International Paper Company and requested them to begin a control project on the southern pine beetle infestation on the lands of the proposed Beech Creek Unit. International Paper Company moved one of their small operators into the area and between April and September 1975, 266 acres of timber were salvaged. In late September the TFS contacted International Paper Company and informed them that the southern pine beetle infestation had continued to increase. TFS inspectors were assigned to the area to assure prompt and efficient removal of infested timber. International Paper Company's largest operator was moved in to assist with the timber removal and from October 1975 to January 1976 an additional 725 acres were salvaged. Figures 2a-2d^{2/} show the acreages of southern pine beetle spots and salvage occurring throughout the salvage period.

During this time publicity and communications from environmental groups, such as the Big Thicket Association, criticizing the cutting being conducted on the unit, continued to increase. In January, when it became evident that the National Park Service would soon buy the land,

^{2/} Figures 2a-2d provided by the Texas Forest Service and are drawn from aerial photographs taken of the unit.

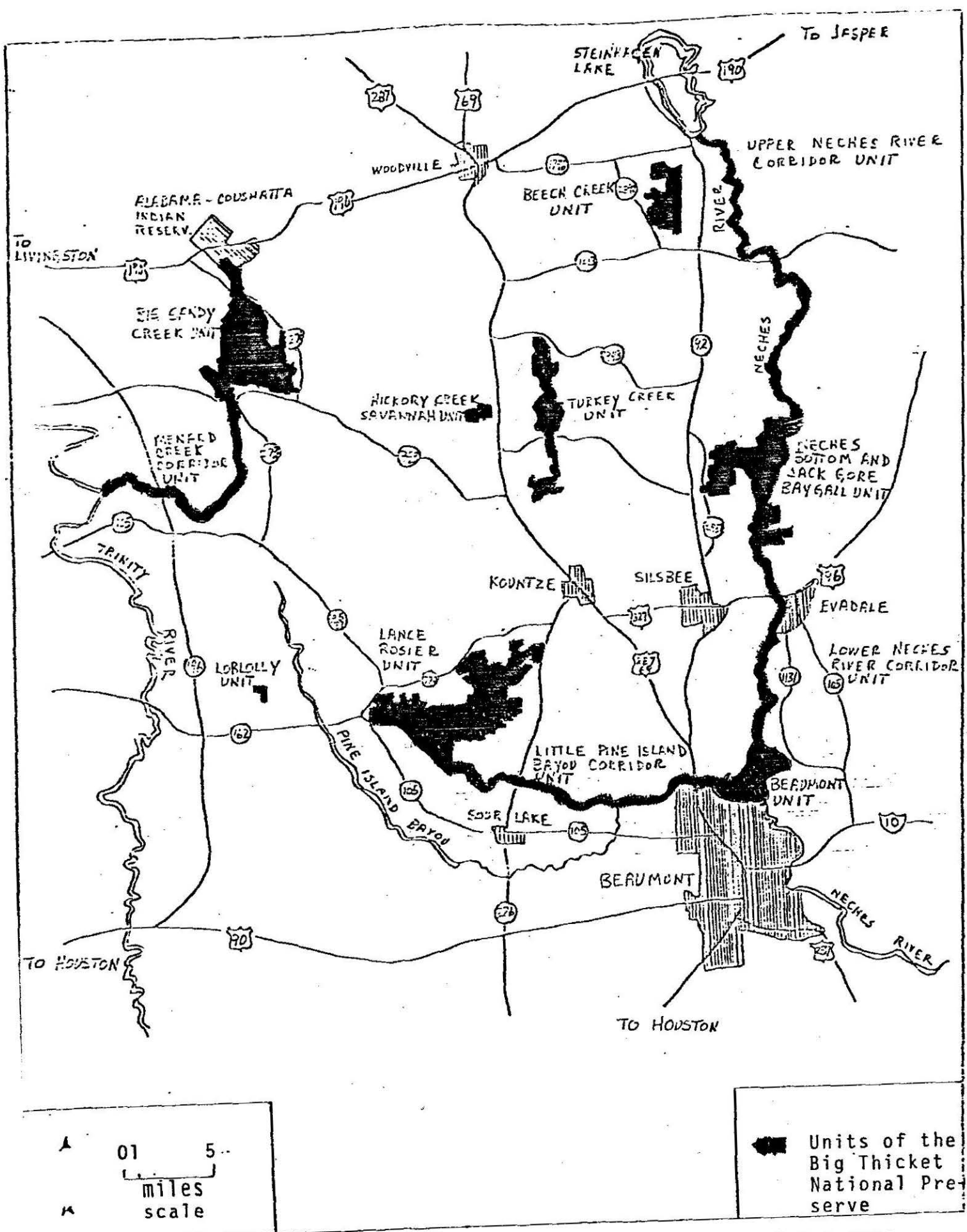


Figure 1. Location of the units of the Big Thicket National Preserve, Texas.

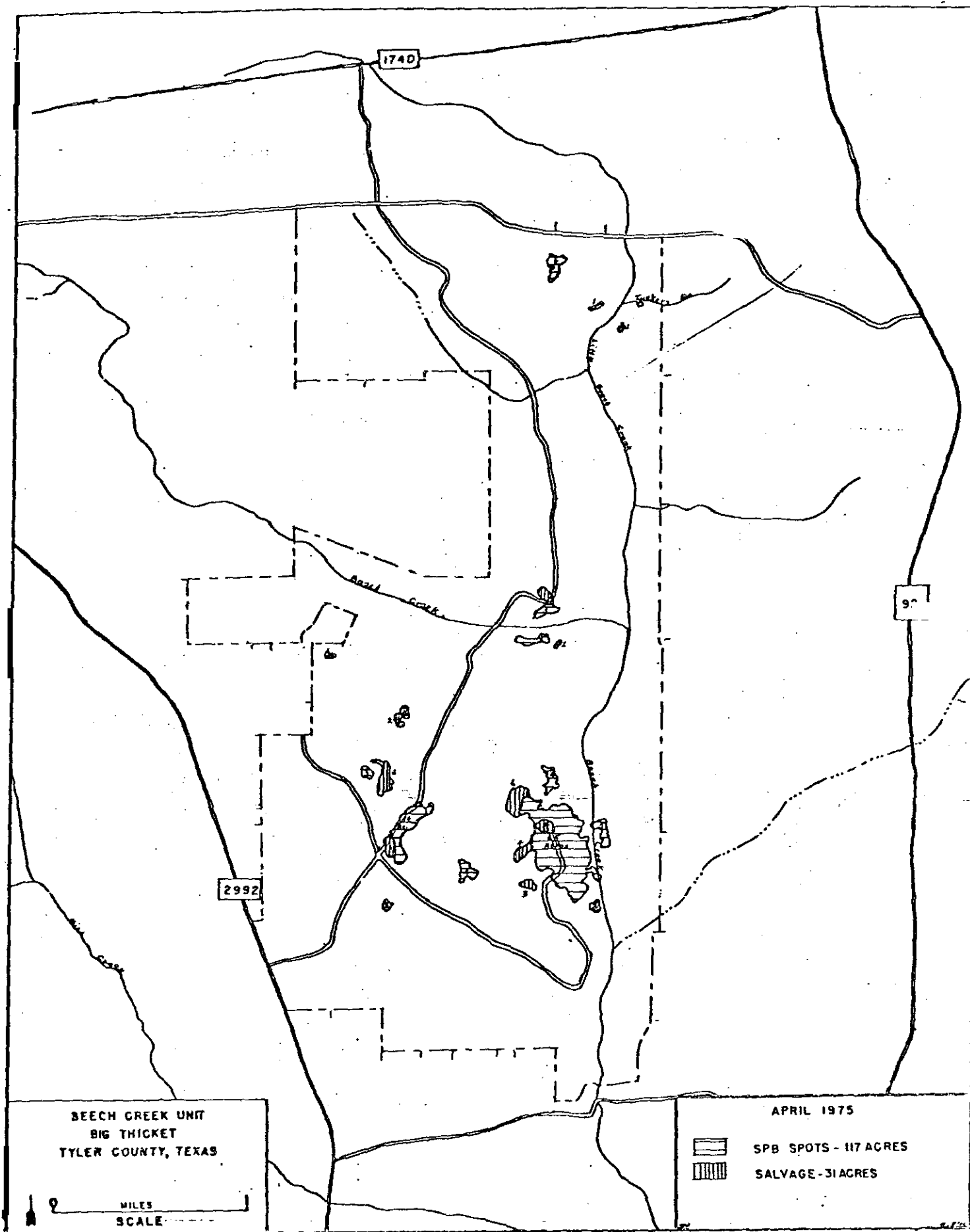


Figure 2a. Location of southern pine beetle spots and salvaged areas on the Beech Creek Unit, Big Thicket National Preserve, APRIL 1975

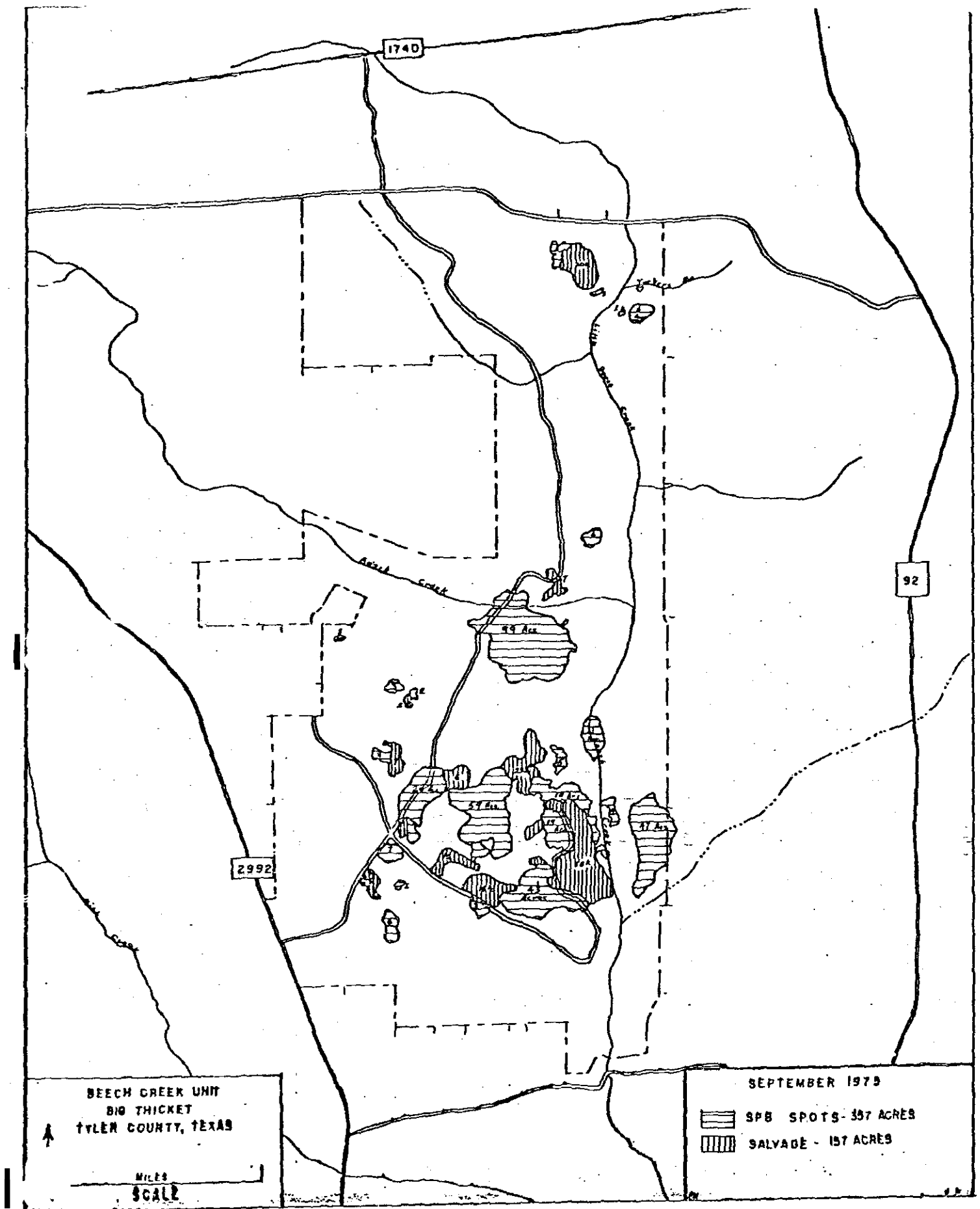


Figure 2b. Location of southern pine beetle spots and salvaged areas on the Beech Creek Unit, September 1975.

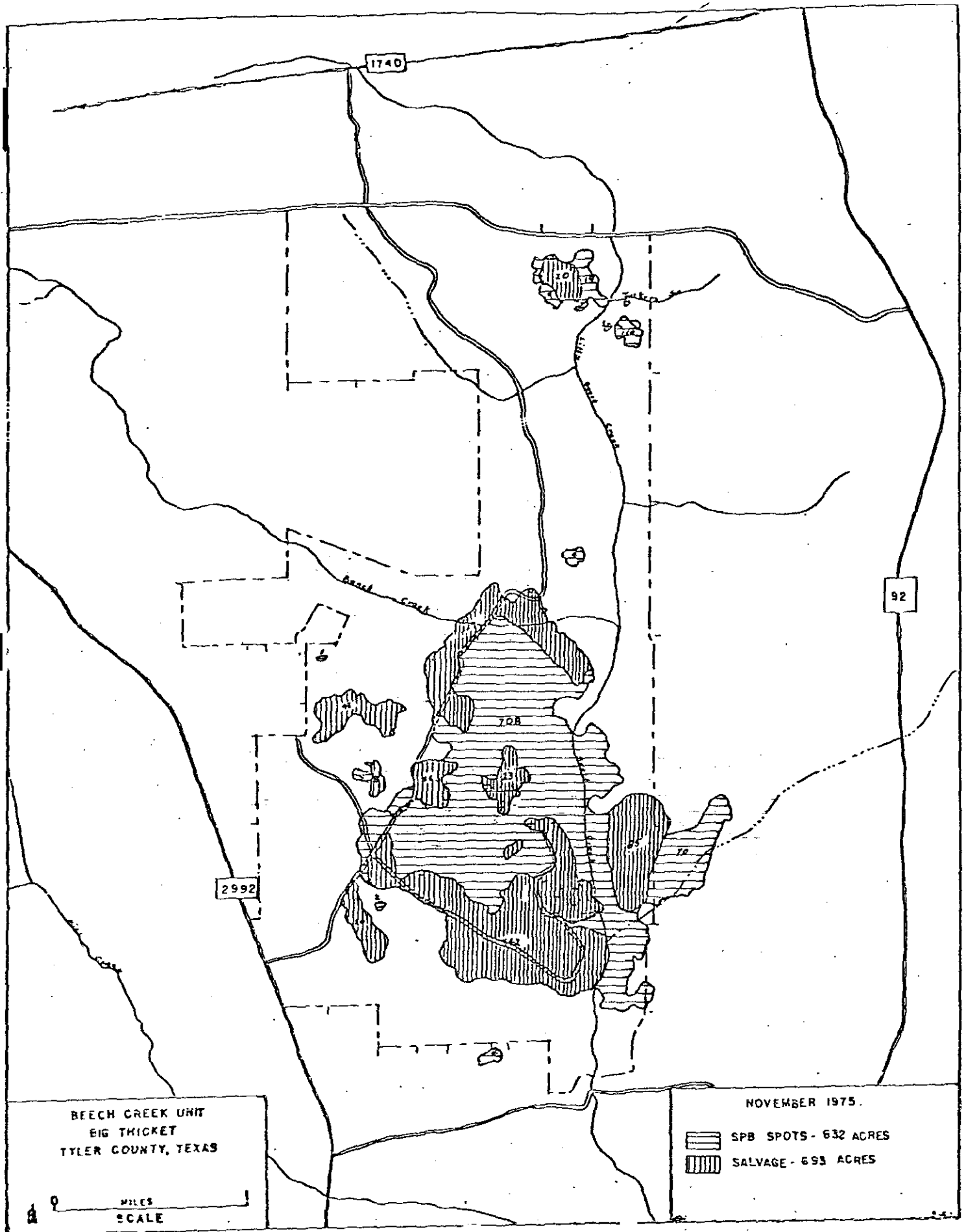


Figure 2c. Location of southern pine beetle spots and salvaged areas on the Beech Creek Unit, November 1975.

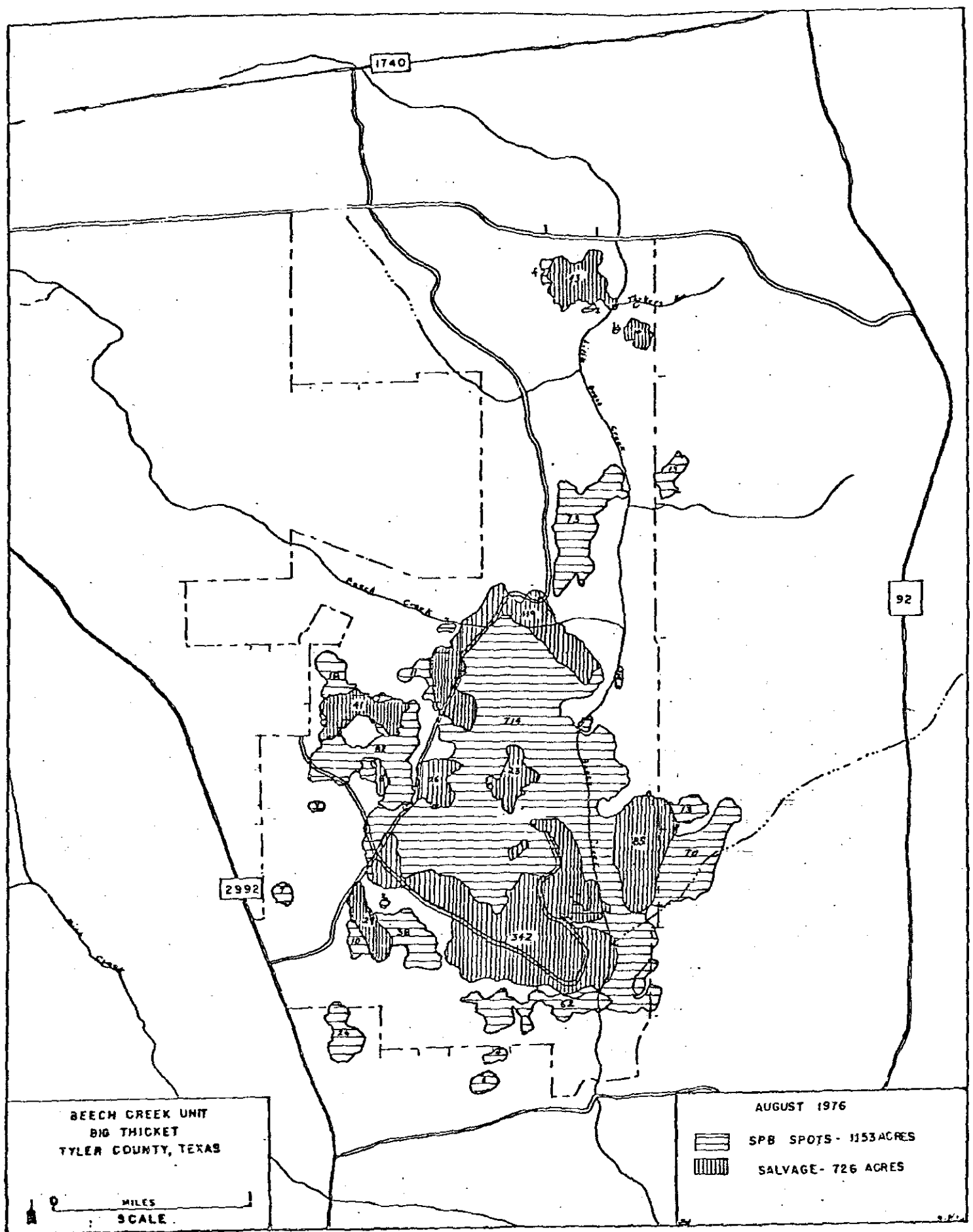


Figure 2d. Location of southern pine beetle spots and salvaged areas on the Beech Creek Unit, August 1976.

International Paper Company pulled the salvage operators out of the unit. This decision was based on National Park policy, pressure from environmental groups, and the current condition of the mills, and the economy. Cutting done on the unit after January was done on small ownerships under the supervision of the Texas Forest Service.

According to a TFS in-service report of an aerial survey and groundcheck conducted in March and April 1976, there were an estimated 451 infested trees on the unit. Since that time the infestation has continued to increase. Figure 2d shows the extent of the southern pine beetle infestation and salvage as of August 1976. Actual acreages are larger than shown on the map as green infested trees are not included.

In September 1976, the Park Service contacted State and Private Forestry, Forest Insect and Disease Management requesting an evaluation to determine the extent of damage and current level of infestation on the units and to give recommendations for handling the southern pine beetle situation on the Preserve.

In October 1976, the Park Service finalized the acquisition of lands within the boundaries of the Beech Creek and Loblolly Units.

TECHNICAL INFORMATION

Insect - Southern pine beetle, *Dendroctonus frontalis* Zimm.

Hosts - The southern pine beetle will attack all species of southern yellow pine. However, loblolly pine, *Pinus taeda* L. and shortleaf pine, *P. echinata* Mill., are preferred hosts. Loblolly is the predominate species of pine on both the Beech Creek and Loblolly Units.

Type of Damage - Death of the tree is the result of mining in the cambium by the southern pine beetle as it constructs egg galleries. The beetle also introduces blue stain fungi, *Ceratozystis* spp., which slow down or block conduction of water in the stem. The size of an infestation may range from a single tree to several thousand trees.

Life Cycle of the Beetle - Southern pine beetles attack in pairs and construct a winding gallery in the cambium. Eggs are deposited in niches along the sides of the galleries. The eggs hatch into whitish grubs that further mine the cambium and then construct cells in the bark where they pupate and change to adults. The new adults then mine through the bark to emerge. The complete life cycle takes about a month during the summer, and as many as six to eight generations may be produced annually in this area.

Environmental Causes^{3/} - The Big Thicket area of southeast Texas is located in a transition zone between the arid southwest and the moist eastern hardwoods, and the tropical coastal marsh and the central prairie. Plants from all of these areas grow together forming a unique community found in no other area.

The climate of the area is subtropical characterized by humid hot summers and mild, wet winters. Precipitation in the region is high with an average annual rainfall of 53 inches. During periods of intense general rainfall, large amounts of water are temporarily stored in the broad, flat valleys and then slowly released to the streams. This produces broad, slow-moving floods which result in extended periods of inundation. The area is subject to periods of severe thunderstorms and damaging winds (including hurricanes and tornadoes).

Mean temperatures range from 54° F in January to 82° F in August. Relative humidity averages 78 percent.

Above average rainfall has occurred in East Texas over the last four years.^{4/} Kalkstein (1976) found that the intensity of insect activity was directly related to moisture surplus and deficit. This, coupled with a cool summer and mild winter in 1975-76, no doubt created a situation that placed the trees under stress and favored beetle development.

METHODS

One hundred percent aerial sketchmap surveys were conducted on both the Beech Creek and Loblolly Units. All spot locations were marked on maps and the larger areas containing red and fading trees were delineated. No attempt was made to determine the areas or numbers of older abandoned black-topped trees. Spots that had spread onto adjacent private lands, and some spots on private land were also mapped.

Some of the spots detected in the air were checked on the ground. Spots were so large that it would not have been feasible to collect data on the whole spot, therefore, data were collected on sample subplots distributed randomly within the spots. Subplots were point sample plots based on a basal area factor of 10. Volume of affected and infested southern pine beetle timber was estimated on a volume per acre basis using basal area and diameters, and the approximate acreages containing red and fading trees.

^{3/} Final Environmental Impact Statement, Big Thicket National Preserve Texas, 1976. National Park Service.

^{4/} Brief on southern pine beetle situation in Texas. August 1976. In-service report, Texas Forest Service.

Observations were also made on condition of trees, and site and stand conditions in areas where the spots occurred.

RESULTS AND DISCUSSION

Beech Creek Unit

The Beech Creek Unit contains over 4,800 acres and lies approximately 25 miles north of Beaumont. It is predominately lower-slope hardwood pine of the beech-magnolia-loblolly association with some mid-slope oak-pine type. A stream runs through the eastern edge of the unit in a north-south direction creating a stream flood plain forest type in that part of the unit. A 5-acre block remnant of the beech-magnolia-loblolly plant association occurs on the unit that represents perhaps the finest example of this plant association on the Preserve. This association occurs almost exclusively in southeast Texas.

According to sketchmap results, there were 19 southern pine beetle spots on this unit. Fourteen spots were less than one acre in size and ranged from 1 to 100 red and fading trees. The remaining five spots were much larger. The estimated sizes of each of these spots were 141, 47, 54, 26 and 210 acres (Fig. 3). This estimated area includes only that acreage containing red and fading trees, therefore, when green infested trees are included the acreage will increase. Although no attempt was made to estimate acreages of older abandoned black-topped trees a significant portion of the unit already contains these dead trees. Figures 4 and 5 are photographs of two of the larger spots on the Beech Creek Unit showing part of the black-topped, red and fading trees in each spot. All five spots were located in or included a lower-slope hardwood-pine type. Average pine basal area within the spots was 105.

There was an estimated 6,618 MBF of southern pine beetle affected timber in the five larger spots and an additional 98 MBF of timber in the fourteen smaller spots for a total of 6,716 MBF. Affected timber includes only those trees with red or fading tops and does not include the black-topped trees. In addition, green infested trees will increase the amount of affected timber. The Park Service does not manage their lands for timber production, therefore, volume is used in this report merely as a measure of the impact of southern pine beetle on the units.

Spots that were ground checked were active and heavily infested with southern pine beetle.

Only one of the spots, the 210-acre spot located on the southern edge of the unit, had apparently spread onto private land. There were two spots on private land - one 200 trees and one 10 trees - located not far from this larger spot.

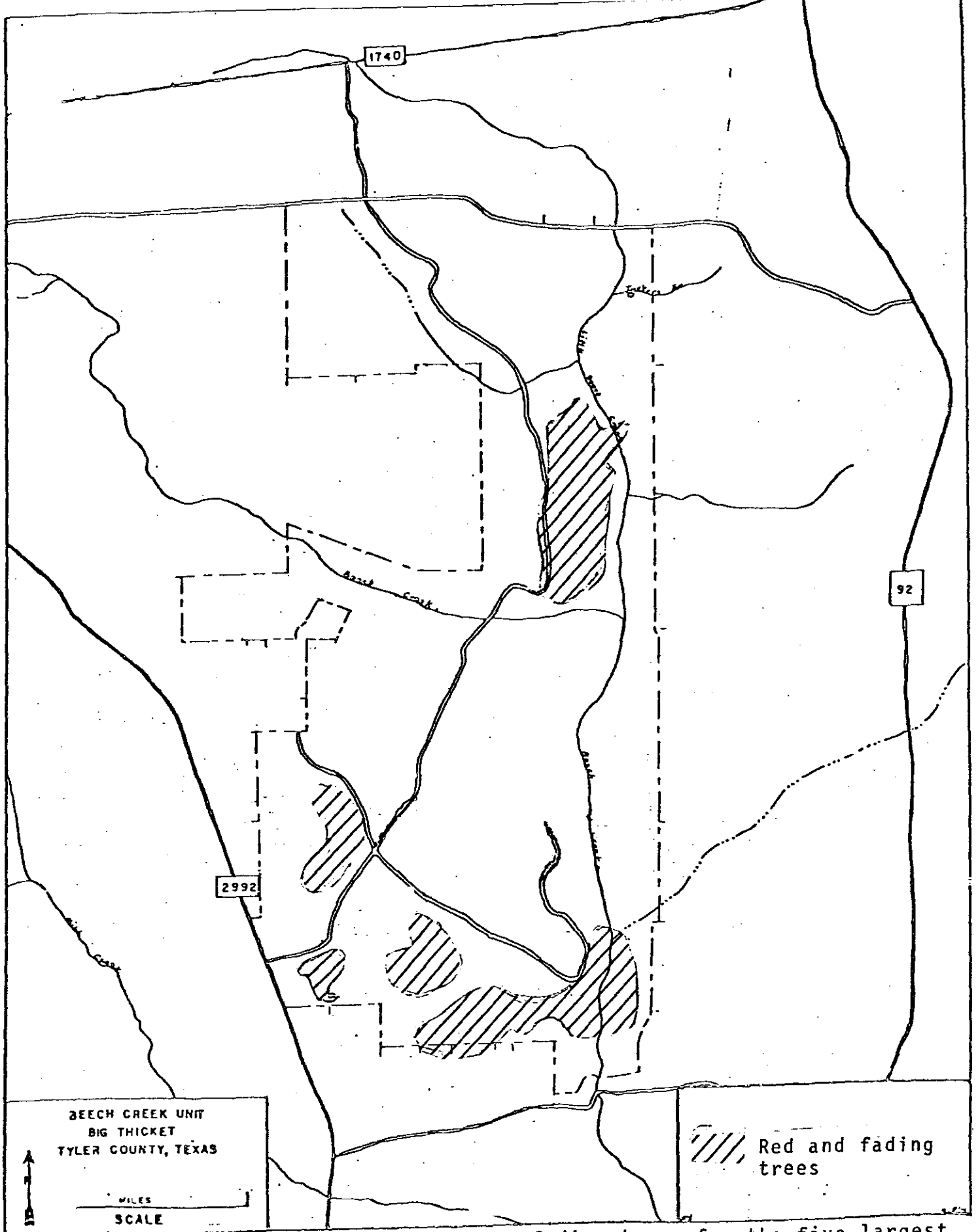


Figure 3. Map showing areas of red and fading trees for the five largest spots on the Beech Creek Unit, Big Thicket National Preserve, Texas, September 1976.



Figure 4. Southern pine beetle spot on the Beech Creek Unit of the Big Thicket National Preserve, September, 1976. Upper left of picture shows area of black-topped trees, smaller spot occurs near top right of picture.



Figure 5. Southern pine beetle spot on Beech Creek Unit showing progression of spot; black-topped trees at the top, red trees in the center, and fading and green infested trees in the lower left corner.

Southern pine beetle spots have been recorded on the lands comprising the unit for several years. According to information provided by the Texas Forest Service, both salvage removal and cut and leave have been used on these lands in the past.

Loblolly Unit

This unit contains 550 acres and is located approximately 30 miles west and northwest of Beaumont. The northern one-half (approximately) of the unit is made up of a hardwood forest type, predominately oak. The remaining southern half of the unit is predominately a mature loblolly pine forest containing very large old pines averaging 24-37 inches in diameter and 130 ft. in height. The significance of this tract is in its demonstration of ecological succession from prairie to a mature forest in the last century, and large mature pines.

According to sketchmap results there are three spots on this unit, all of which cross over onto private land. Figure 6 shows the location of the spots. The two largest spots were estimated at 20 and 26 acres, respectively. The average pine basal area taken within plots in this unit was 90. There was an estimated 579 MBF of timber killed by southern pine beetle. Again, affected timber includes red and fading trees, but does not include infested green trees which will increase the total affected volume. Most of the pine within this unit has already been killed by southern pine beetle. Pine type surrounding this unit is limited, although spots have spread onto private land there is little further potential damage. Figure 7 shows a southern pine beetle spot on the Loblolly Unit.

DISCUSSION

Most of the pine timber in both the Beech Creek and Loblolly Units have already been killed by southern pine beetle. If suppression measures are not initiated it is very likely that most of the remaining pines in these units will be killed.

The application of suppression measures depends on the objectives of the Park Service and is a decision for the Park managers. Since spots are large it will be necessary to set suppression priorities. One of the major concerns is that southern pine beetle in these spots will spread to adjacent private lands. If the decision for suppression is made, those spots endangering private lands or unique plant communities, such as the 5-acre tract of beech-magnolia-loblolly, should be given high priority. Spots with the most advanced broods should be treated first.

To aid in determining priorities it may be necessary to take aerial true-color or infrared photographs of the Preserve units and adjacent private lands in the Preserve to determine the exact location of pine both on the units and the surrounding lands.

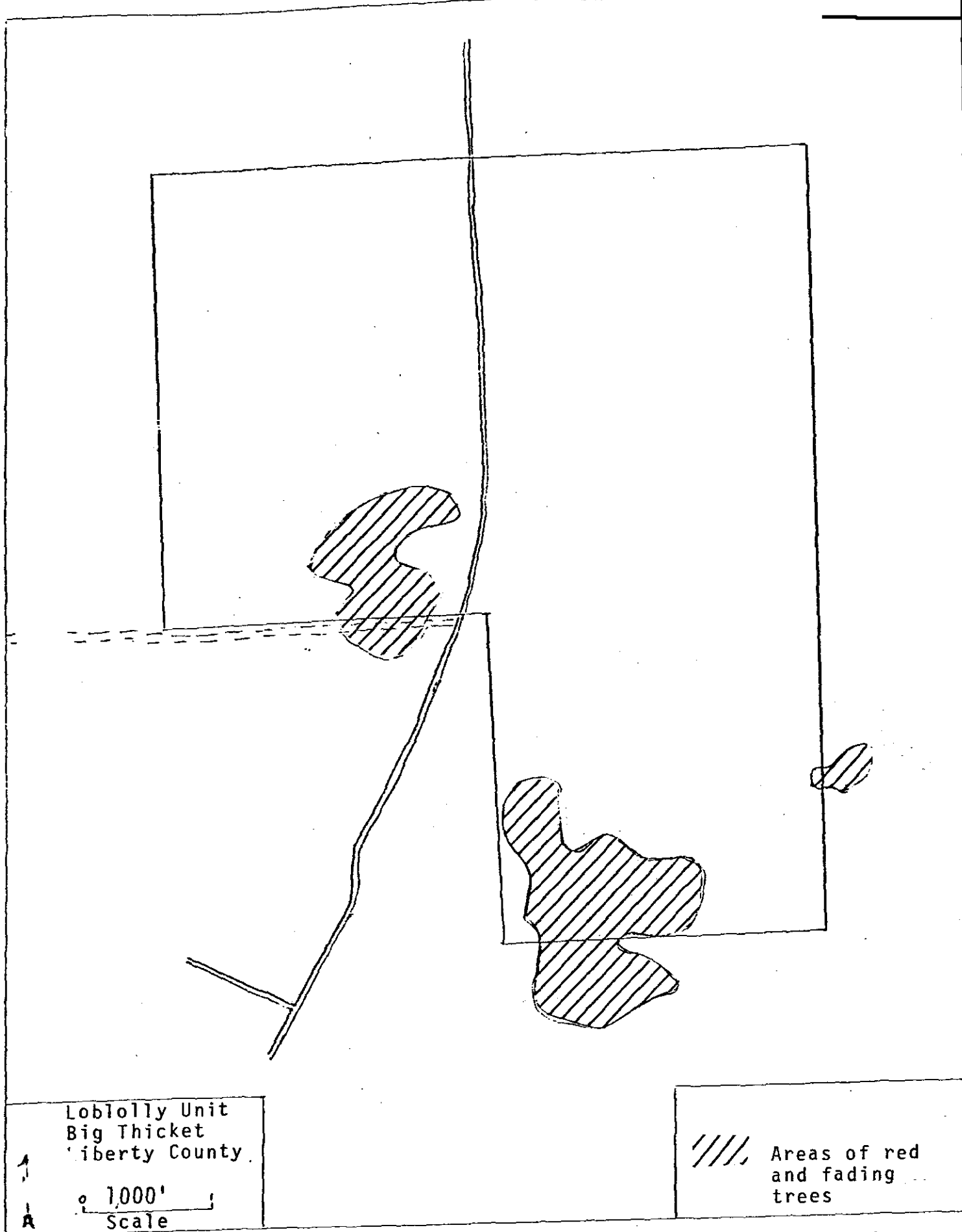


Figure 4. Map showing areas of red and fading trees for spots on the Loblolly Unit, Big Thicket Preserve, Texas, September 1976.



Figure 7. Southern pine beetle spot on the Loblolly Unit of the Big Thicket National Preserve, Texas, September 1976. The pipeline marks the boundary of the unit and shows how the spot has spread to adjacent lands.

Where suppression is desirable, the Forest Service recommends three methods of suppression for southern pine beetle: 1) removal of infested trees, 2) pile and burn, and 3) cut and spray with 1/2 percent lindane in No. 2 fuel oil or water. Of these methods, removal of infested trees is often the most widely used. This would entail locating and removing only the actively infested trees from the spot under a carefully supervised operation to keep disturbance to the environment to a minimum. A buffer strip is normally recommended. If a buffer strip is not used, it is critical to check the areas two to three weeks after treatment for breakout. In some instances, removal of infested trees may not be possible or may need to be used in conjunction with chemical treatment. Lindane occurs on the restricted list of chemicals for the Department of the Interior and permission would have to be obtained for its use.

RECOMMENDATIONS

Should a decision for suppression be made, the following are recommended:

1. Regularly scheduled aerial surveys should be continued. During the winter, after hardwood leaf fall, photographs - either true color or infrared - could be taken of the higher priority Preserve units and adjacent private lands.
2. Removal of infested trees is the most feasible method of control. Removal should be conducted around the active head first, including a buffer strip if possible.
3. Where removal is not possible, infested trees should be cut and treated with lindane. Pesticides should be used with caution and as directed on the label.
4. In some instances, cutting, piling, and burning the infested trees may be an acceptable alternative. This involves thoroughly burning the infested bark.
5. Priorities should be placed on spots with attention directed to those spots immediately endangering adjacent private lands or unique plant communities.

A copy of the Forest Service guidelines for southern pine beetle suppression from FSM 5250 and a precautionary pesticide use statement are attached for information.

LITERATURE CITED

Kalkstein, Laurence S. 1976. Effects of climatic stress upon outbreaks of the southern pine beetle. Environ. Ent. 5(4) : 653-658.

GUIDELINES (from FSM 5250)

If a southern pine beetle suppression project is conducted, guidelines should be followed as presented in the 5250 section of the Forest Service Manual:

1. Removal of Infested Trees by Commercial Sale or Administrative Use. When infested trees of merchantable size are accessible, they should be removed by commercial sale or administrative use procedures. Logging of infested material should begin immediately. Contract time limits should insure rapid removal.

Where practical, and if host type is present, a 40- to 70-foot buffer strip should be marked and cut adjacent to and ahead of the most recently infested trees. This practice is effective in reducing the possibility of "breakouts". When only a small volume of infested merchantable material occurs in a spot, noninfested trees surrounding the spot may be marked to provide an operable cut. The order of priority for removing beetle infested timber from a spot should be as follows:

Trees having nearly developed broods (usually the red and fading trees)

Trees having young broods (usually the green, recently infested trees)

Trees in the buffer zone.

2. Piling and Burning. Unmerchantable or inaccessible southern pine beetle infestations can be suppressed by cutting, piling, and thoroughly burning the bark of infested trees. The entire bark surface must be thoroughly burned to insure effective control. The order of priority for cutting, piling, and burning infested trees, particularly the large spots, is the same as paragraph (1) under removal of infested trees by commercial sale or administrative use. Cutting a buffer strip is not recommended. To reduce the possibility of "breakouts" every effort should be made to locate and treat all green infested trees during the piling and burning operation.
3. Chemical Control. Chemical formulation recommended for southern pine beetle control is a 1/2 percent lindane spray with No. 2 fuel oil as the carrier. This may be formulated from a 20 percent lindane emulsifiable concentrate or oil concentrate at the rate of 11 pints of concentrate to enough fuel oil to make 55 gallons of spray. (Ratio of one part 20 percent lindane EC to 39 parts No. 2 diesel fuel).

Cut, limb, and buck all infested trees into workable lengths. Spray the infested bark surface to the point of run-off. A compressed air sprayer (3-gallon capacity or equivalent) is an ideal applicator. Infested logs must be turned two or three times to insure complete treatment of infested bark. Spray stumps and bark removed by woodpeckers. Low pressure sprayers may be used to treat large, accessible infestations.

The order of priority for cutting and spraying infested trees in large spots is the same as paragraph (1) under removal of infested trees by commercial sale or administrative use. Cutting a buffer strip is not recommended. To reduce the possibility of "breakouts", every effort should be made to locate and treat all green infested trees during the chemical control operation.

Never spray trees from which southern pine beetle brood has emerged. Natural enemies of the southern pine beetle in these trees can then complete their development. To prevent aerial spotters from mapping treated spots, cut trees with red needles from which beetles have emerged.

Instructions for minimizing the adverse effects of mixing, transporting and storing pesticides, applying pesticides and disposing of pesticide containers and excess chemicals are outlined in Section 8.3 of the Forest Service Health and Safety Code and FSM 5242.21. Detailed safety procedures should be outlined in the project suppression plan.

4. Reexamination of Treated Areas. Reexamine areas where infested trees were removed by commercial sales, piled and burned, or chemically treated within two or three weeks after treatment to check for additional infested trees. If additional trees are found, treat them.

PRECAUTIONARY PESTICIDE USE STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key -- out of the reach of children and animals -- away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.